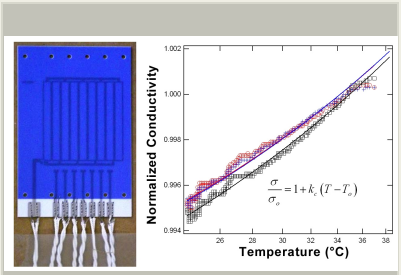
Small Business Innovation Research/Small Business Tech Transfer

In-Situ Real-Time Temperature Monitoring of Thermal Protection Systems, Phase I

Completed Technology Project (2014 - 2014)

Project Introduction

This program addresses the need for interfacial and in-depth temperature monitoring of thermal protection systems (TPS). Novel, linear drive, eddy current methods are proposed that incorporate innovative sensor array constructs, physics-based models, and multivariate inverse methods to nondestructively assess temperatures for carbon-based TPS materials such as felts and PICA. The sensors can be mounted behind the TPS material or embedded within the TPS with sensing fields that are projected through the material to the far surface interface. Thermally induced changes in the electrical properties of the TPS material are then used to determine the temperatures. In Phase I, the focus is on establishing feasibility by demonstrating correlations between electrical properties measured by the eddy current sensors and the TPS temperature. It will also investigate adaptation of the sensor materials to support sustained and transient operation at high temperatures compared to typical operating conditions for standard eddy current sensors. JENTEK's physics-based methods for diagnostics of layered media using MWM-Array technologies have been demonstrated in scanning configurations for coating characterization, corrosion detection and sizing with and without interference layers, and condition and thickness assessment of felt-based TPS materials. These methods have also been extended to surface mounted sensing applications such as torque, fatigue, and heat treatment condition monitoring. JENTEK delivered the MWM-Array solution used by NASA KSC on the Space Shuttle leading edge to detect damage of the reinforced carbon-carbon (RCC) thermal protection tiles; thus after establishing the property correlations with temperature, JENTEK is well-positioned to deliver a novel method for temperature monitoring of TPS materials and material condition monitoring at elevated temperatures.



In-Situ Real-Time Temperature Monitoring of Thermal Protection Systems Project Image

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Images	3
Technology Areas	3
Target Destinations	3

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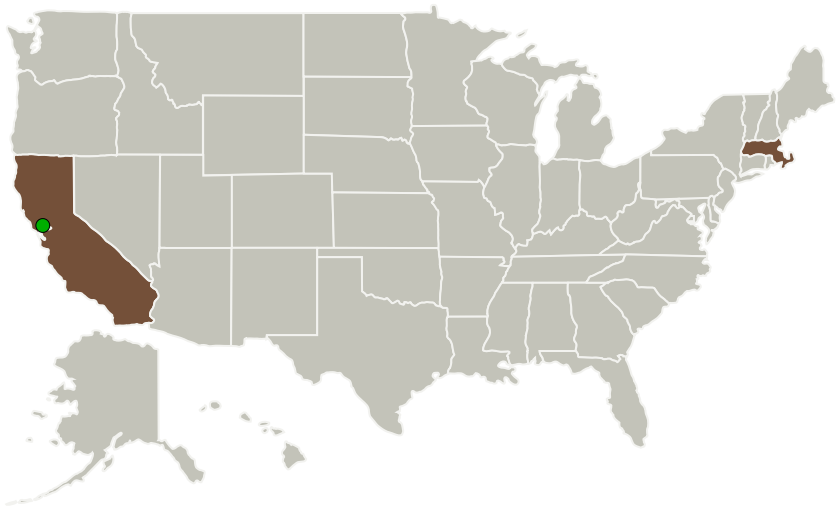
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
JENTEK Sensors, Inc.	Lead Organization	Industry	Waltham, Massachusetts
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Massachusetts

Project Transitions

June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137607)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

JENTEK Sensors, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

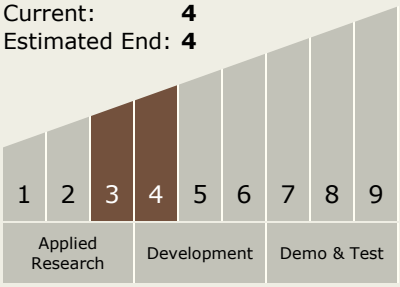
Carlos Torrez

Principal Investigator:

Andrew Washabaugh

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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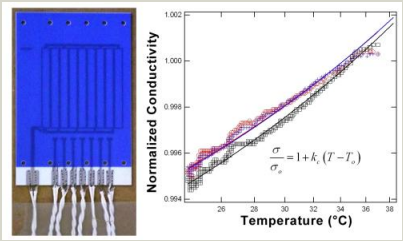
Images



Project Image
In-Situ Real-Time Temperature Monitoring of Thermal Protection Systems Project Image
(https://techport.nasa.gov/image/131890)

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.3 Thermal Protection Components and Systems
    - TX14.3.5 Thermal Protection System Instrumentation

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System